PATENT SPECIFICATION (11) 1 289 819

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DRAWINGS ATTACHED

(21) Application No. 15357/70 (22) Filed 1 April 1970

(23) Complete Specification filed 30 June 1971

(45) Complete Specification published 20 Sept. 1972

(51) International Classification F16B 19/10, 15/04 // 13/04

(52) Index at acceptance F2H 11B 16B 16E 17AU 31D 31F 31G

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(54) IMPROVEMENTS RELATING TO FIXING DEVICES

(71) We, BONDED DIRECT FIXINGS LIMITED, a British Company of 30, Grove Road, Hounslow, Middlesex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns fixing devices.

In its broadest aspect, the invention provides a fixing device comprising a shank having at least a portion divided longitudinally and internally tapered, and an expander displaceable within said divided portion of the shank and co-operating with the internal taper thereof to accomplish expansion of said shank portion, said expander having driving means extending through longitudinal slots in said shank to enable displacement of said expander to be accomplished by movement of said driving means relatively to said shank.

A fixing device in accordance with the invention may, for instance, be embodied in the form of a tubular rivet having a head and a shank divided at least at its free end by longitudinal slots, being fitted with an expander having radial lugs that extend through said longitudinal slots in the shank so as to constitute the driving means for the expander. Said lugs maybe adapted, for instance, to engage the surface of a sheet through which such a rivet is driven, thereby to accomplish the required displacement of the expander within the rivet shank as the latter is driven into its final position. The said lugs may, however, alternatively be arranged to co-operate with a driving ring or washer encircling the shank and in turn adapted for engagement with the sheet surface during driving of the rivet.

Alternatively the fixing device may be embodied in the form of a plug intended to be secured within a suitable bore in a first component or structure (e.g. a wall or floor) so as to enable a second component to be attached to the first by the use of said plug as an anchorage. In such embodiments of the invention, the plug may comprise a headed shank longitudinally divided at least at its free end and internally tapered to receive an expander having lugs projecting laterally through longitudinal slots in said shank. The head of the plug may take any desired form, e.g. eyebolt, hook, threaded stud or it may be formed with a recess, screw-threaded or plain, to receive a bolt, woodscrew or fixing pin as required.

In other embodiments of the invention, the said shank may have an undivided leading end to facilitate its pentration into material in which the device is to be fixed and in these embodiments of the invention the said shank conveniently comprises a tip portion and a divided body portion constituted by at least two substantially parallel limbs together defining a tapered recess receiving the said expander.

In one such embodiment of the invention, the shank body portion is constituted by two substantially parallel limbs having opposed ramped surfaces defining a tapered recess complementary with and receiving an expander wedge. Whilst such an emodiment may have its shank formed of any suitable material, as hereinafter explained, this particular form lends itself to fabrication from profiled wirestock by a folding operation similar to that used in the formation of an engineering split cotter pin.

In accordance with a further feature of the invention, such embodiments of the invention may have the limbs constituting the body portion of the shank provided at their free ends with lateral lugs that constitute a head. These lugs may conveniently be contained within a cap both to provide a required external configuration and/or a driving face, and to prevent unwanted separation of the free ends of the limbs either as a result of displacement of the expander or under driving loads applied to this end of the shank.

Fixing devices in accordance with the invention may be made of a variety of materials depending upon the intended usage thereof. For instance, in the case of embodiments in the form of a rivet, the body of the device may be constructed of metal, e.g. steel, or of non-metallic material such as a plastics material, the expander being formed either of the

same material as the shank or from a different material. In the case of embodiments in the form of plugs a convenient material of construction for both the body and the expander is nylon.

Fixing devices in accordance with the invention may be adapted for driving into position by conventional (manual) tools or they may be adapted for driving by power, e.g. cartridge-operated tools.

Certain embodiments of the invention are illustrated by way of example in the accompanying drawings, in which:

FIGURE 1 is an axial sectional view of a rivet embodying the invention;

FIGURE 2 is an elevation of the expander and driving means of the rivet of Figure 1, also showing the cross-sectional configuration of this expander at various points in the length thereof;

FIGURE 3 is an axial sectional view of the rivet of Figure 1 after installation to secure two sheets together;

FIGURE 4 is an axial sectional view of a plug embodying the invention;

FIGURE 5 illustrates the plug of Figure 4 after installation;

FIGURE 6 is an axial sectional view of an expanding nail embodying the invention; and

FIGURE 7 is an elevation of the nail of Figure 6 from a viewpoint indexed 90° to that of Figure 6.

A typical rivet in accordance with the invention and adapted for driving by means of a cartridge-powered tool and without pre-drilling of the sheets to be riveted together, is illustrated in figures 1 to 3 of the drawings and comprises a mild steel headed tubular shank 1 having four longitudinal slots 2 extending for the full length of the shank and dividing this into four tongues 3 united by a head 4. At their leading ends, the tongues 3 are internally chamfered to fit a four-sided taper wedge 5 on a hardened steel expander (see Figure 2) comprising a pin 6 fitting within the rivet shank 1 and having four lateral lugs 7 projecting through the longitudinal slots 2 in the latter to constitute driving means, the leading end of the expander being formed with a conical point 8 backed by the four-sided taper wedge 5 that locates on the chamfered ends of the tongues 3 of the shank. The lugs 7 protrude from the shank near the mid-point of the length thereof and are adapted to be engaged by a driving ring 9 in the form of a steel washer that encircles the rivet shank.

When such a rivet is driven by a cartridge-powered tool the point 8 of the expander penetrates the sheets (e.g. the sheets 10, 11 shown in Figure 3) to be secured by the rivet and forms a suitably sized hole for the shank of the rivet; during the final movement of the rivet shank through this hole, the driving ring 9 engages the adjacent sheet surface and effectively arrests the continued movement of the expander which is thus displaced towards the head of the rivet as the shank is driven home. As a result of this displacement of the expander, the four tongues 3 of the shank are expanded and turned laterally outwardly by the wedge 5 of the expander so as to achieve a secure fixing of the rivet without the use of an anvil.

Figures 4 and 5 illustrate a plug in accordance with the invention adapted for fixing by hammer drive in a suitable hole, e.g. in a wall. The plug shown in these Figures comprises a tubular shank 12 constituted by four substantially parallel, arcuate-section, limbs extending from a head 13. As shown, the leading end portion of the shank 12 is internally tapered and receives an expander 14 in the form of a conical wedge that at its upper or smaller end is formed with a cruciform structure that extends through longitudinal slots between the limbs constituting the shank 12 of the plug, the cruciform structure having its extremities linked by a ring 15.

The plug is conveniently formed of plastics material, the headed shank and the expander both being formed, for instance, as nylon or similar mouldings. The underside of the head 13 of the plug is preferably formed, as shown, with a recess complementary to the ring 15.

As clearly shown in Figure 5, the plug may be introduced into a pre-drilled hole, e.g. in a wall, until the ring 15 engages the outer surface of the material in which the hole is formed, to prevent further entry of the expander into the hole, subsequent movement of the shank of the plug into the hole resulting in relative displacement of the expander within the shank and expansion of the latter into firm gripping engagement with the wall of the hole. When the shank is fully driven home, it overlies the ring 15.

Figures 6 and 7 illustrate an expanding nail embodying the invention. This nail comprises a shank 17 having a tip 18 and a pair of substantially parallel limbs 19 formed by folding profiled wirestock upon itself in a manner similar to that in which engineering split cotter pins are formed. The tip 18 is ground or otherwise formed to a pointed shape to facilitate penetration and the opposed faces of the limbs 19 are formed with ramped surfaces 20 defining a recess complementary in shape to an expander wedge 21 that is received within this recess and has a cross bar 22 that projects from between the limbs 19 on opposite sides of the shank 17 and co-operates with a driving ring 23.

The free ends of the limbs 19 are outturned to form lateral lugs 24 and a cap 25 is fitted over these lugs 24 to prevent their separation and to provide a driving face to receive hammer blows or the like. The expander 21 and the cap 25 are preferably formed of hardened

steel whereas the shank and driving ring may be formed of mild steel wirestock and sheet respectively.

WHAT WE CLAIM IS:—

1. A fixing device comprising a shank having at least a portion divided longitudinally and internally tapered, and an expander displaceable within said divided portion of the shank and co-operating with the internal taper thereof to accomplish expansion of said shank portion, said expander having driving means extending through longitudinal slots in said shank to enable displacement of said expander to be accomplished by movement of said driving means relatively to said shank.

2. A fixing device according to claim 1 and comprising a tubular rivet having a head and a shank divided at least at its free end by longitudinal slots, being fitted with an expander having radial lugs that extend through said longitudinal slots in the shank so as to constitute the driving means for the expander.

3. A fixing device according to claim 2, wherein said lugs are adapted to co-operate with a driving ring or washer encircling the shank.

4. A fixing device according to claim 1, comprising a plug having a headed shank longitudinally divided at least at its free end and internally tapered to receive an expander having lugs projecting laterally through longitudinal slots in said shank.

5. A fixing device according to claim 1, wherein said shank comprises a tip portion and a divided body portion constituted by at least two substantially parallel limbs together defining a tapered recess receiving said expander.

6. A fixing device according to claim 5, wherein said shank and body portion is constituted by two substantially parallel limbs having opposed ramped surfaces defining a tapered recess complementary with and receiving an expander wedge.

7. A fixing device according to claim 6, wherein said shank is formed of profiled wirestock folded upon itself.

8. A fixing device according to claim 5, 6 or 7, wherein the free ends of said limbs have lateral lugs constituting a head.

9. A fixing device according to claim 8, wherein said lugs are contained within a cap.

10. A fixing device substantially as described with reference to and as shown in Figures 1 to 3 of the accompanying drawings.

11. A fixing device substantially as described with reference to and as shown in Figures 4 and 5 of the accompanying drawings.

12. A fixing device substantially as decribed with reference to and as shown in Figures 6 and 7 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1972.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1289819 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

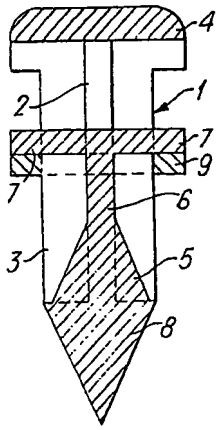

Fig.1.

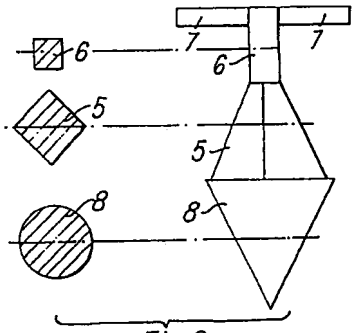

Fig.2.

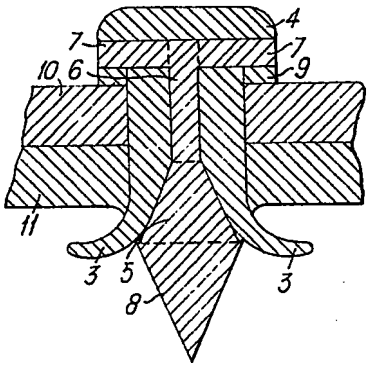

Fig.3.

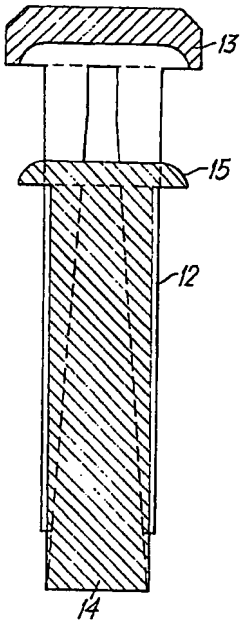

Fig.4.

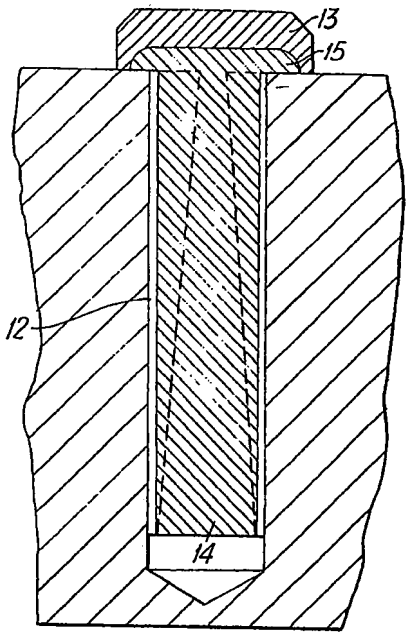

Fig.5.

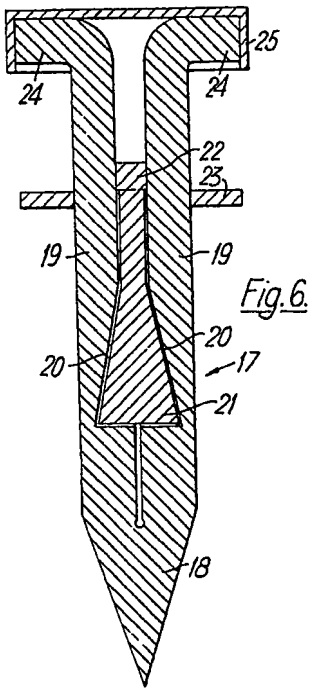

Fig.6.

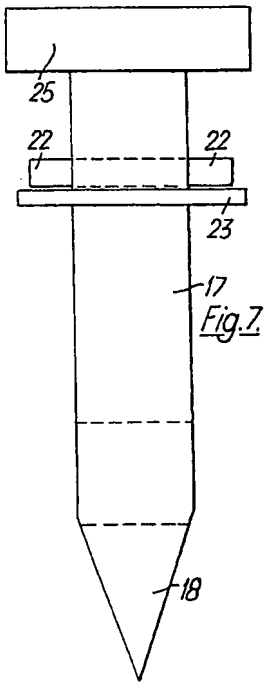

Fig.7.